Combined Structural and Operational Plan
Overview and Purposes and Objectives

1.0 PURPOSE

The Combined Structural and Operational Plan (CSOP) is an integrated structural and operational plan for two modifications of the Central & South Florida (C&SF) project – known as the Modified Water Deliveries (MWD) project and the C-111 canal (C-111) project. The purpose of CSOP is to define the operations for the C-111 and Modified Water Deliveries projects that would be consistent with their respective project purposes as defined by the authorizing legislation and further refined by subsequent general design memoranda (GDM) and general reevaluation reports (GRR).

The purpose of this paper is to define the planning process to be utilized in selecting an operating plan in accordance with the authorized project purposes.

2.0 CSOP PLANNING CONDITIONS

2.1 Defining a Common Point of Reference

The C-111 and MWD projects are hydrologically linked to each other and the larger regional water management system and must have an integrated operating plan. The C-111 and MWD projects were authorized by separate Congressional legislation over time that resulted in the use of different planning assumptions during the development of the recommended plans. CSOP must define a common point of reference that demonstrates how each CSOP alternative compares with respect to the total project benefits and impacts that were reported in previous authorizing documents.

The base condition described in the 1992 MWD GDM consisted of the best estimate of the physical and operational water management system that would have existed with no modification resulting from MWD project. This condition has commonly been referred to as the "Base 83 condition". This condition included the structural features of the South Dade Conveyance System and operational policy as they existed in 1983 and water deliveries to ENP being made in accordance with the schedule specified in PL 91-282 (Minimum Delivery Schedule, 1978 Lake Okeechobee Regulation Schedule).

Alternative structural and operational plans were compared to the Base 83 condition in development of the recommended plan for the MWD project. The recommended plan was selected on the basis of expected environmental benefits derived from implementing a modified water delivery schedule. Mitigation for flood damages was determined by comparing the modified water delivery schedule to the Base 83 condition to determine

the structural modifications to the C&SF project that were needed to implement a modified water delivery schedule.

Subsequently, the base condition described in the 1994 C-111 GRR consisted of a "modified Base 83 condition" that included the authorized structural modifications associated with MWD project that were yet to be constructed. This was appropriately selected to represent the best estimate of the physical and operational water management system that would exist without further modification of the C-111 project. Specifically: 1) the SDCS canals and structures would be operated in accordance with the design optimal canal stage criteria (Table 2-1, 1994 C-111 GRR); 2) S-331 would be the divide structure between the NESRS and South Dade county areas and would not be utilized to pump flood waters out of the SRS basin to prevent flood damages in the 8.5 SMA but would only be used, as designed, for water supply deliveries to South Dade county during drought conditions; 3) water deliveries to ENP would be made in accordance with the Minimum Delivery Schedule.

All structural modification alternatives for the C-111 project modifications were evaluated using the design operating criteria for flood control and water supply and were compared to the modified Base 83 condition. The focus of the GRR was to develop a structural plan that provided the greatest flexibility in providing restoration while maintaining flood damage reduction. It was recognized that additional studies would be necessary to identify an integrated operating strategy for C-111 and MWD projects that would optimize the environmental benefits in accordance with the authorizing documents.

The basis for determining the performance of alternatives for the 8.5 SMA component of the MWD in the 2002 8.5 SMA GRR utilized multiple comparisons. Alternatives were compared to the modified 1983 Base condition to determine mitigation requirements. Alternative comparisons to the 1995 Base condition were used to determine impacts of each alternative to conditions existing at the time of the study. Alternatives were also compared to the authorized 1992 MWD GDM plan under both the modified Base 83 operations and the 1995 Base operations.

Not only did the base condition from which project benefits and impacts were measured change over time in accordance with the legislative authorizations and changing project conditions, the hydrologic models used to evaluate the alternatives continued to evolve over time. For instance, the 83 Base condition and alternative plans evaluated for the 1992 MWD GDM utilized an early version of the SFWMM (2X2) and included the 1978 Lake Okeechobee regulation schedule. The 1994 C-111 GRR utilized the 1X1 model with inputs from the 2X2 model for the 1965-1989 period of record. The 2002 8.5 SMA GRR used the MODBRANCH model, which simulates short term events, with boundary inputs from the 2X2 for a wet-year (1995) and a dry-year (1989).

The original Base 83 and modified Base 83 conditions used in the prior analyses no longer represent a valid future without project condition due to the subsequent Congressional actions that approved the C-111 and MWD project modifications that are

currently under construction. These 83 base conditions do not include any operational criteria for the already constructed features of the C-111 project modifications, nor do they include additional changes in the regional system that have occurred since these project modifications were authorized. Specifically, the implementation of the WSE schedule for Lake Okeechobee or the implementation of the STA's in the EAA area. More recently, the Record of Decision on the Interim Operational Plan (IOP) for Protection of the Cape Sable seaside sparrow currently represents the project operations for the C&SF project features in the south Dade area that are to remain in-place until CSOP is implemented or some other federal action is taken.

However, there is a need to identify a common point of reference from which CSOP alternatives will be compared that demonstrates how each CSOP alternative compares to the intended project purposes that were reported in previous authorizing documents. The use of a base condition that does not include the structural modifications authorized by the MWD and C-111 projects would enable an absolute comparison of CSOP alternatives project outputs consistent with the authorizing documents. An updated modified Base 83 condition would provide this common point of reference.

This common point of reference must also be able to allow an evaluation of effects resulting from structural and operational alternatives without regard to other changes to the regional system. Therefore, the modified Base 83 condition must be further modified (updated) to include recent changes in the regional system, i.e. WSE and STA operations. This will become the base condition for CSOP from which all CSOP alternatives will be compared and optimized to achieve the authorized project benefits. However, this base condition does not represent the minimum level of flood damage reduction to be provided by the projects. Nor will the use of this base condition as a point-of-reference be considered a viable without-project condition, or in any way be construed as determining the pre-CERP baseline conditions or assumptions, or construed as defining existing legal sources, under Section 601(h)(5) of the Water Resource Development Act of 2000.

2.2 Minimum Level of Project Performance for Environmental Restoration

The MWD and C-111 project modifications are under construction as a result of the federal action that authorized those modifications. Consistent with the documents that provided the basis for their authorizations, the remaining action for CSOP is to develop an integrated operating plan that optimizes the environmental benefits while maintaining the other authorized project benefits.

The target levels and performance measures for environmental restoration will be developed during CSOP and used to indicate how well each alternative meets the objectives for CSOP within the constraints defined for project implementation.

2.3 Minimum Level of Project Performance for Flood Damage Reduction

Through the 1989 Everglades Expansion Act, WRDA 1996 and, more recently, the Congressional action on the 8.5 Square Mile Area, Congress has authorized the

recommended plans for the Modified Water Deliveries to Everglades National Park and C-111 project modifications. The Corps is charged with implementing those plans to provide the benefits associated with those authorized project modifications. The 1994 C-111 GRR considered the prior authorization for project modifications described in the 1992 MWD GDM and included those structural features in development of the recommended plan for modifications to the C-111.

Similarly, CSOP must also consider that Congress has authorized both plans for implementation. Thus, for purposes of determining if the minimum level of flood damage reduction performance described in the authorizing documents has been achieved, CSOP alternatives will be compared to the 1994 C-111 GRR recommended plan (Alternative 6A), including the operating plan that was used to justify the recommended plan. The mitigation for increased stages resulting from the implementation of the 1992 MWD GDM recommended plan, as modified by the 2000 8.5 SMA GRR, must also be maintained while preserving the level of flood damage reduction associated with the 1994 C-111 GRR recommended plan. The level of flood damage reduction specified in these supporting documents represents the minimum level of performance for CSOP. This will enable a determination as to whether CSOP alternative operational plans provide the benefits associated with the authorized project modifications. The recommended plan for CSOP must meet this minimum level of performance for flood damage reduction. If the analysis shows that it is not possible to achieve the environmental restoration contemplated by the authorized projects while maintaining the minimum level of performance for flood damage reduction, the USACE will seek approval to pursue additional project modifications consistent with and limited by the project objectives identified in Section 3.

The C-111 project modifications authorized in accordance with the 1994 C-111 GRR were analyzed under optimum canal stages and design water levels. Optimum and design water levels in the project canals were established on the basis of desirable water control conditions in each area for environmental and flood control purposes, i.e. optimum groundwater levels, intake and/or discharge structure elevations and removal rates for flood control. Water availability was limited to basin rainfall, existing S-331 water supply releases and seepage inflows resulting from the restoration of Shark River Slough associated with Modified Water Deliveries to Everglades National Park (USACOE, 1994 C-111 GRR pg A-6).

The 1994 C-111 GRR focused on the structural features south of the S-331 pump station. The area of focus was south of S-331 because S-331 served as a basin divide structure. Operation of this structure would therefore be limited to supplemental water deliveries in dry periods.

The following table includes information on the recommended plan taken directly from the 1994 C-111 GRR. The “optimal canal stages” shown in column 2 represent the target stage for the canal reach specified under normal conditions. During flood events, the canal reach may exceed these optimal canal stages. Similarly, during drought conditions, the canal reach may recede below these optimal levels. Canal stages are permitted to

recede approximately 1.5 feet below these optimums before supplemental water for water supply is introduced into the SDCS from WCA-3A. The "structure design criteria" shown in column four represents the design water levels and discharge capacities for the C-111 GRR recommended plan associated with the 40% Standard Project Flood (40% SPF).

1994 C-111 GRR Recommended Plan Optimum and Design Criteria

Canal/Structure	Optimum Canal Stages (stages recede 1.5-ft below optimum for WS)	1994 C-111 GRR Reference	Structure Design Criteria (40% SPF design water levels and discharge capacities)	1994 C-111 GRR Reference
S-331	5.0 (US41-S331)	Table A-8	Water Supply to South Dade Only 7.2 tw	Pg 8-7, Plate A-12
S-332 A	5.5 (S331-S176)	Table A-8	300 cfs 5.5/8.0 hw/tw	Table A-5
S-332 B	5.5 (S-331-S176)	Table A-8	300 cfs 5.5/8.0 hw/tw	Table A-5
S-332 C	5.5 (S331-S176)	Table A-8	300 cfs 5.5/8.0 hw/tw	Table A-5
S-332 D	5.5 (S331-S-176)	Table A-8	300 cfs 5.5/8.0 hw/tw	Table A-5
S-332B-D Retention/Detention Area (24-36" dia culverts at 1000-ft intervals and 300-ft overflow spillway)	Culverts 7.0 hw/6.5 tw optimum	Table A-19	Culverts sized to pass 50% of max pumping capacity of S-332B, C and D with 0.5-ft head difference. 17.3 cfs per culvert 8.3 varies /7.8 varies hw/tw spillway sized to pass 50% of max pump capacity	pg A-23 Table A-19 Plate A-8
S-332 E	2.0 (S177-S18C)	Table A-8	50 cfs 3.0/4.0 hw/tw	Table A-5, Pg 7-2
S-332	4.5 (S174-S175)	Table A-8	165 cfs 4.5/.5.5 hw/tw	Table A-5
S-175	4.5 (S174-S175)	Table A-8	500 cfs 5.0/4.5 hw/tw	Table A-5
S-194	5.5 (L31N-S165)	Table A-8	Water Supply to South Dade Only – closed during flooding	pg A-26
S-196	5.5 (L31N –S167)	Table A-8	Water Supply to South Dade Only- closed during flooding	pg A-26

S-176	5.5 (S331-S176)	Table A-8	630 cfs 6.0/5.5 hw/tw	Table A-5 Plate A-10
S-177	4.5 (S176-S177)	Table A-8	1400 cfs 4.3/3.7 hw/tw	Table A-22 Plates A-10, A-11
S-18 C	2.0 (S177-S18C)	Table A-8	2100 cfs 2.6/2.1 hw/tw WS (2.0)	Table A-22
S-197	None	Table A-22	Closed to maintain optimum stages and salinity control. Releases per guidelines during major flood events. 2400 cfs 1.4/0.6 hw/tw	pg A-26, A-27, pg 8-6 Table A-22
S-178	Structure for local drainage, no optimum	Pg A-26	300 cfs 3.9(tw)	Plate A-11

References:
Central and Southern Florida Project, Supplement 54, General Reevaluation Report and Environmental Impact Statement, Canal 111 South Dade County, Florida, May 1994.

2.4 No Action Alternative

The MWD and C-111 project modifications are under construction as a result of the federal action that authorized those modifications. Consistent with the documents that provided the basis for their authorizations, the remaining action for CSOP is to develop an integrated operating plan that optimizes the environmental benefits while maintaining the other authorized project benefits. Additionally, since the more recent ROD on IOP states that IOP will be in-place until CSOP is implemented, the most probable "no action alternative" would include the MWD and C-111 authorized structural features in-place and operated according to the IOP criteria. This configuration will be considered as one of the alternatives in the CSOP analysis.

Considering that the project modifications have now been authorized by Congress and that considerable changes have occurred in the system since then, the 1983 base case can no longer be considered a realistic future without project condition. The Base 83 condition does not include any operational criteria for the authorized and constructed C-111 features as well as other modifications that have occurred within the larger regional system. Since the action for CSOP is to develop an operational plan for the authorized "project" modifications, it will be sufficient to identify a no action alternative and a base condition, and there is not a need to label any specific condition as the "future without project condition".

3.0 CSOP PLANNING OBJECTIVES

3.1 Authorized Project Objectives

1. Restore historic hydrologic conditions in the Taylor Slough, Rocky Glades, and eastern Panhandle of the ENP. (Source[1]: USACE 2002 C-111 GRRS, Section 5.1: Planning Goals and Objectives, page 5-1)

2. Protect the natural values associated with the ENP. (Source[1]: USACE 2002 C-111 GRRS, Section 5.1: Planning Goals and Objectives, page 5-1)

3. Eliminate the damaging freshwater flows to Manatee Bay/Barnes Sound and increase flows to northeast Florida Bay from the lower C-111. (Source[1]: USACE 2002 C-111 GRRS, Section 5.1: Planning Goals and Objectives, page 5-1)

4. Maintain the level of flood damage reduction associated with the 1994 C-111 GRR recommended plan. (Source: USACE 1994 C-111 GRR)

5. Maintain the mitigation for project induced flood damages in the East Everglades, including the 8.5 Square Mile Area, the Osceola Indian Camp, and the Tiger Tail Indian Camp (Source: USACE 1992 MWD GDM, Chapter G: Mitigation and Monitoring Measures, Section 54 (a): Reason for Phase, page 41)

6. Ensure that C-111 project waters diverted to ENP meet all applicable water quality criteria. (Source[1]: USACE 2002 C-111 GRRS, Section 5.1: Planning Goals and Objectives, page 5-1)

7. Construct modifications to improve water deliveries into ENP and take steps to restore natural hydrologic conditions in ENP by:
    a. Timing: Changing the schedule of water deliveries so that it fluctuates in consonance with local meteorological conditions, including providing for long term and annual variation in ecosystem conditions in the Everglades;
    b. Location: Restoring WCA 3B and Northeast Shark Slough as a functioning component of the Everglades hydrologic system;
    c. Volume: Adjusting the magnitude of water discharged to ENP to minimize the effects of too much or too little water.
    (Source: USACE 1992 MWD GDM, Section 44: Objectives, page 24-25)

3.2 Additional Objectives

1. Maximize compatibility with future authorized restoration actions including, for example, the CERP C-111 Spreader project and the water availability for the Model Lands.

[1] The USACE 2002 C-111 GRRS is expected to be approved in the near future.

2. Minimize impacts associated with construction.

3. Minimize adverse socio-economic effects.

4. Maximize cost effectiveness consistent with the restoration objectives.

5. Minimize non-ENP wetland functional losses associated with detention zone construction.

6. Explore opportunities for an enhanced level of flood damage reduction for the C-111 Basin east of L-31N and C-111 canals consistent with the restoration objectives, the USACE's authority for the MWD and C-111 projects and operational considerations.

7. Protect the natural values of WCA-3A and 3B.

8. Explore opportunities for enhancing the recovery of federally listed species under the Endangered Species Act, consistent with the restoration objectives, the USACE's authorities for MWD and C-111 projects and operational considerations.

9. Explore opportunities for enhancing the well-being of species listed by the State as endangered, threatened or of special concern consistent with the restoration objectives, the USACE's authority for the MWD and C-111 projects and operational considerations.

3.3 Planning Constraints

1. Restoration of the ENP will be accomplished in a manner consistent with the ENP's enabling legislation and the mission of the National Park Service. (Source: 48 Stat. 816: May 30, 1934 and U.S.C., Chapter 1, Subchapter 1, Section 1:1916).

2. Minimize adverse effects to federally listed species under the Endangered Species Act. (Source: USACE 1992 GDM, Chapter E: Objectives and Constraints, Section 4: Problems and Constraints, page 26)

3. Minimize adverse effects to state listed endangered or threatened species or species of special concern consistent with Florida Statutes and regulations. (Source: Chapter 372, Florida Statutes (2001); Chapter 68, Florida Administrative Code)

4. Meet applicable water quality standards.

5. Maintain the original purposes of the C&SF project of flood damage reduction, regional water supply for agricultural and urban areas, prevention of saltwater

intrusion, preservation of ENP, water supply to the ENP, preservation of fish and wildlife resources, recreation, navigation and ecosystem restoration.

6. Ensure no significant impact to existing habitat of endangered or threatened Species (Source: USACE 2000 GRR and Final SEIS 8.5 SMA, Section 4.0 Evaluation criteria, 4.2 Project Requirements, page 38).

7. Ensure consistency with other applicable federal and State laws and regulations.

3.4 Planning Assumptions

1. The following assumptions are made regarding the 8.5 SMA features of the MWD project in accordance with the July 2002 8.5 SMA GRR/SEIS.

   (A) The periodic flooding of landowners east of the proposed [perimeter] levee, before and after project implementation, will remain unchanged from conditions in existence prior to implementation of the MWD project. Flood mitigation, not flood protection, should be provided by the design and operation of the Recommended Plan [Alternative 6D]. No deviations are intended from the operations specified in the Manual [Operations and Maintenance Manual] (i.e. increased pumping in the seepage canal or the inclusion of additional pumps) due to anticipated public demand for increased relief inside the perimeter levee of the 8.5 SMA project.

   (B) Implementation of the Recommended Plan [Alternative 6D] shall not adversely harm the restoration levels of ENP's hydrology greater than that simulated through the modeling of Alternative 6D. A monitoring, evaluation, and reporting program shall be implemented to ensure operations are consistent with these levels.

   (C) Operations of the 8.5 SMA project shall be detailed in an Operations and Maintenance Manual. As appropriate, this Manual shall be agreed to by ENP, USFWS, USACE, and SFWMD, and include provisions for monitoring, emergency operations, as well as mechanisms for dispute resolution to assure compliance in a manner satisfactory to all agencies.

2. Project features associated with the Tamiami Trail component of the Modified Water Deliveries Project will be consistent with the 2001 TTP DSEIS. Specifically, the road features are designed to pass a total maximum discharge of 4000 cfs through a new 3000-foot bridge coupled with the existing bridges and culverts. The maximum design water level in the L-29 canal is 9.3 feet-NGVD.

3. Ecosystem restoration is the primary goal of the MWD and C-111 project modifications. CSOP will optimize the environmental restoration reduction benefits of the C-111 project, while maintaining flood damage reduction.

4. Pump station S-331 will be used for water supply purposes. Flood mitigation for the 8.5 SMA will be transferred to S-357. The C-111 project features will be operated in accordance with the purposes of the C-111 project and other C&SF project purposes as required.

5. Pump station S-356 will be used in a manner consistent with the authority of the MWD project and other CS&F project purposes, as required. S-356 will be used for seepage control.

3.5 Issues

Issues will be identified through the CSOP multi-stakeholder and NEPA scoping processes.

4.0 BACKGROUND

The following was prepared by an interagency team consisting of staff from the U.S. Fish and Wildlife Service, U.S. Army Corps of Engineers, South Florida Water Management District, and Everglades National Park. It is drawn primarily from the various authorizing documents pertaining to the Modified Water Deliveries (MWD) project and the C-111 Canal (C-111) project. This document summarizes important background information about the Combined Structural and Operational Plan (CSOP) for the MWD and C-111 projects, clarifies the U.S. Army Corps of Engineers' policy and practice with respect to flood damage reduction projects, and provides reference sources for new participants. This document, used in conjunction with participation of stakeholders and the public, establishes a framework of common understanding and thereby facilitates the identification of project related issues, development of alternatives, development of performance measures, and the development of a recommended plan for CSOP.

This document does not modify existing authorizations. Any disputes over the language of any authorization or authorizations will be based on the specific public law and all resulting authorizing documents to provide the most complete context practical. This document does not exclude any existing authorization nor does it preclude new authorizations.

4.1 Combined Structural and Operating Plan Overview

The Central and Southern Florida (C&SF) project extends from south of Orlando to the Florida Keys and is composed of a regional network of canals, levees, storage areas and water control structures. First authorized by Congress in 1948, the project serves multiple purposes. The authorized purposes of the project include flood control, regional water supply for agricultural and urban areas, prevention of salt water intrusion, water supply to Everglades National Park, preservation of fish and wildlife, recreation, navigation, ecosystem restoration and preservation of Everglades National Park.

The Combined Structural and Operational Plan (CSOP) is an integrated structural and operational plan for two modifications of the C&SF project – referred to as the Modified Water Deliveries (MWD) project and the C-111 canal (C-111) project. Both the MWD and C-111 projects are integral parts of the C&SF project. The existing C-111 canal and adjacent canals are the result of a number of changes from the initially conceived plan for the southern area of the C&SF project. The intent of CSOP is to be consistent with the purposes of the MWD and C-111 projects modifications as defined by the authorizing legislation and further refined by subsequent general design memoranda, general reevaluation reports and supplements to these documents. Specifically, the purpose of CSOP is to define the operational plan for these C&SF project modifications which was not included in previous design documents.

In brief, the goal of the MWD project is to construct modifications to the original C&SF project to improve water deliveries to the Everglades National Park (ENP). Similarly, the primary goal of the C-111 project modifications (1994 C-111 GRR) is the restoration of

the ecosystem in Taylor Slough and the eastern panhandle of ENP. It is important to realize that CSOP will develop the operational plan to meet these goals and is not a flood damage reduction project in and of itself. The operational plan is, in effect, a vital component of the MWD and C-111 modifications needed to provide for restoration. These goals of the MWD and C-111 projects are to be accomplished while preserving the other authorized purposes of the C&SF project.

4.2 C-111 Project History

In the late 1950's local interests in southern Dade County requested the C&SF project be modified to provide an adequate system of canals to provide drainage for urban development, with water control structures to prevent over-drainage of agricultural lands and contamination of groundwater by saltwater intrusion. The United States Army Corps of Engineers (USACE) published a Survey Review Report on South Dade County in 1959, which was published in Senate Document 87-183 and authorized by the 1962 Flood Control Act. The Flood Control Act of 1962 authorized a project for southern Dade County to remove 40-percent of the standard project flood runoff from the drainage area, to reduce depth and duration of larger floods, and to provide water control to prevent over-drainage of the area. To accomplish this, the plan provided for gravity drainage of the South Dade area by a primary system of 12 canals, including the C-111, and provided the necessary outlets to serve a system of secondary canals proposed by local interests. Local interests were responsible for constructing and maintaining lateral drainage facilities as necessary to realize the benefits made available by the federally authorized project improvements.

The plan recommended in the 1962 Act was reviewed in the 1963 General Design Memorandum for South Dade County and was modified to effect conciliation of the desires of the ENP, local interests, and land developers. The plan was designed to remove the 40-percent standard project flood (SPF) from the entire 196 square mile drainage area without exceeding the design water surface profile, reduce the depth and duration of floods of greater magnitude than the 40-percent SPF, prevent over-drainage of the area by maintaining optimal water levels in the project canals, insofar as possible, and controlling discharge within permissible limits, prevent saltwater intrusion from entering the area through the canals and water control structures and to provide facilities to convey up to 500 cubic feet per second to ENP when normal runoff is available within the natural drainage limits. The proposed plan required the construction of L-31N and L-31W and their borrow canals for a distance of 21 miles, extending south from the existing part of L-31N to a point about 1.5 miles south of State Road 27. The purposes of the L-31N and L-31 W canals and levees were to protect South Dade County area from overflow from the west and to provide water supply to ENP.

The Everglades National Park-South Dade Conveyance System (SDCS) was authorized by the 1968 Flood Control Act. In the 1973 General Design Memorandum for the plan outlined in the 1968 Flood Control Act, modifications included enlarging existing canals such as the C-111 to permit supplemental water supply from WCA-3A to south Dade County and ENP. The plan was designed to serve the dual purpose for water control; (1)

to maintain adequate elevations in the canals to recharge groundwater and (2) maintain head at the coastal structures to prevent saltwater intrusion. In addition to maintaining water surface elevations, the plan recognized that adequate head must be available to transport or convey water throughout the system and yet not create excessive transient seepage losses with too high a water surface elevation. No additional flood damage reduction, beyond the level provided in the 1962 authorization was authorized for the C-111 area as a result of this Act. The USACE terminology has shifted towards the use of the term "flood damage reduction" projects, as opposed to "flood damage protection" projects, to better convey the intended function of federally authorized flood projects. See Sections 4.4 and 4.5 for a description of the flood damage reduction terminology.

Environmental concerns caused construction to be discontinued before all authorized project features recommend in the 1962 Flood Control Act were completed. In 1970, Congress enacted Public Law 91-282 which prescribed a monthly schedule of minimum water deliveries that must be provided to ENP from the C&SF project. From 1983 through 1988 additional studies were conducted to complete the authorized plan of improvement for flood control, environmental enhancement and water management in the C-111 basin as constructed. The recommended plan contained in the 1988 C-111 GDM Addendum 2 focused on preventing large, damaging discharges to Barnes Sound via S-197 and to increase flows to northeast Florida Bay via flows from the lower C-111. From 1988 to 1990, several actions developed which changed the scope and schedule for completion of the C-111 report.

The United States Congress, finding that the Everglades National Park is a nationally and internationally significant resource and the park has been adversely affected and continues to be adversely affected by external factors which have altered the ecosystem including the natural hydrologic conditions within the park, enacted in 1989 the Everglades National Park Protection and Expansion Act (PL-101-229). Section 104 of the Act authorized modifications to the CS&F project to improve water deliveries to ENP and take steps to restore ENP natural hydrologic conditions. The Secretary of the Army was also directed in the analysis, design and engineering associated with completion of works and operations in the C-111 basin area of the East Everglades, to take all measures which are feasible and consistent with the purposes of the C&SF project to protect natural values associated with ENP. The Act further stated in Section 104 that nothing in this section should be construed to limit the operation of C&SF project facilities to achieve their design objectives, as set forth in the Congressional authorization and any subsequent modifications thereof.

The U.S Fish and Wildlife Service (USFWS) submitted a proposal in 1989 to revise their Fish and Wildlife Coordination Act (FWCA) report, including an assessment of benefits and impacts to fish and wildlife resources. USFWS proposed an east-west spreader canal between C-111E and US Highway 1. The USFWS also proposed the plugging of C-109 and C-110 to promote sheetflow and to provide dry season refuge. Sheetflow would be provided by overflows from C-111 through gaps in the southern spoil mounds.
From 1989 to 1994, the Corps continued to work with the SFWMD, ENP and USFWS to address plans which would protect the natural values of ENP while preserving the other

authorized project purposes. As a result of this continued project reformulation effort to reconcile the desires of the stakeholders and complete the C-111 project in response to the 1962 and 1968 Flood Control Acts, PL 91-282, and the legislative direction contained in the Everglades National Protection and Expansion Act of 1989 requiring the Secretary of the Army to "take all measures which are feasible and consistent with the purposes of the (C-111) project to protect natural values associated with the Everglades National Park", the USACE completed the C-111 General Evaluation Report (GRR) in 1994. The 1994 C-111 GRR recommended additional modifications to provide restoration of the ecosystem in Taylor Slough and the eastern panhandle of ENP, while maintaining flood damage reduction within the C-111 basin. As such, one of the objectives stated in the C-111 GRR was to preserve the existing level of flood damage reduction in the C-111 basin east of L-31N and C-111. The document also states that the original operating levels and discharge capacities were intended to provide flood damage reduction for storms up to the 40-percent SPF. The 1994 GRR further states that the flood protection preservation objective involves maintaining the original design canal stages and discharge capacities while restoring more natural hydrologic conditions within ENP. The design optimal canal stages are summarized in Section 2.2 of the 1994 GRR. All alternatives examined in the C-111 GRR, including the recommended plan, were evaluated based on maintaining design optimal canal stages under these flood conditions. Results of these evaluations indicated that the additional capacity provided by the S-332A, B, C and D pump stations addressed the objective of maintaining flood capacity by pumping to the buffer area and discharging surface waters to ENP. The 1994 GRR further identified that although the plans were evaluated using design optimal canal stages, the focus of the GRR was to develop a structural plan that provided the greatest flexibility in providing restoration while maintaining flood damage reduction and that a detailed design study and development of an operational plan would be conducted subsequent to the 1994 GRR. Therefore, the purpose of the 1994 GRR was to maintain the level of flood damage reduction already provided by the authorities of the Flood Control Acts of 1962 and 1968, not to augment or diminish these already existing benefits.

The original objective to maintain the level of flood damage reduction was re-affirmed with the release of the C-111 GRR Supplement in January 2002. The 2002 C-111 GRR Supplement was prepared in response to new authorities resulting from the passage of Public Law 104-303, the Water Resources Development Act of 1996. Section 528 of that law allows the Secretary of the Army to protect water quality by constructing features determined necessary to provide sufficiently clean water to ENP. The 2002 GRR Supplement did not reformulate the project authorized in the 1994 GRR but recommended features to be incorporated into the authorized plan. No additional hydraulic modeling was performed for the Supplement and the report re-iterated that studies necessary to determine the operating plan were to be conducted subsequent to this Supplement. The CSOP study will determine the operational plan for both the C-111 and MWD projects.

4.3 Modified Water Deliveries (MWD) Project History

In November 1983, Congress passed Public Law 98-181 (also referred to as the Supplemental Appropriations Act of 1984) authorizing a program of experimental water deliveries for ENP. This law provided the authority to deviate from the minimum delivery schedule in effect at the time and conduct iterative field tests for the explicit purpose of improving water deliveries to the ENP. In response to this authority, the USACE completed an Environmental Assessment (EA) and Finding of No Significant Impact (FONSI) in June 1985 which specified the conditions for the first official iteration, Iteration 1, of the Experimental Program.

Iteration 1 of the Experimental Program was conducted for a period of two years, from June 1985 through May 1987. Iteration 1 included operational changes which allowed for deviations from the regulation levels in Water Conservation Area 3A, increasing the quantity of water discharged to the east into Northeast Shark River Slough (NESS), and also a lowering of water levels in south Miami-Dade canals to offset any potential adverse impacts associated with the additional discharges to the east. Iterations 2 through 5 of the Experimental Program were essentially extensions of the conditions associated with Iteration 1.

Based on the results attained from the first five iterations of the Experimental Program, Iteration 6, or the Taylor Slough Iteration, was conducted to expand the program into other regions of ENP. Specifically, the objectives of this iteration were to evaluate methods to restore more natural hydroperiod and ecosystems within ENP including NESS and Taylor Slough, as well as, reduce large freshwater discharges through S-197 into Manatee Bay and Barnes Sound. In general, this test included all of the operational components of the first six iterations, with the addition of auxiliary pumps at pump station S-332 in order to increase the discharge capacity into Taylor Slough from 165 cfs to 500 cfs.

Iteration 7 was the final iteration of the Experimental Program of Water Deliveries to ENP. This test attempted to remedy some of the problems identified in previous iterations, particularly Iteration 6. The purpose of Iteration 7 was to identify an improved water delivery plan for Taylor Slough. Acquisition of lands in the Frog Pond allowed for increased operational levels within the L-31W canal, which allowed for the testing of Taylor Slough water delivery plan based on L-31W stage targets predicted from an analysis of historical rainfall in the Taylor Slough basin. Additional operational flexibility was also achieved through the construction of pump station S-332D, and changes in the operational levels of the L-31N canal.

The Experimental Program of Water Deliveries was terminated in 1999 based on concerns of the U.S Fish and Wildlife Service regarding the status of the endangered Cape Sable seaside sparrow. As a result of these concerns, the USACE initiated two interim operational plans for the benefit of the Cape Sable seaside sparrow, while preserving other C&SF project purposes. The initial plan adopted by the USACE was

referred to as the Interim Structural and Operational Plan or ISOP and was replaced by the current plan, the Interim Operational Plan or IOP.

The Everglades National Park Protection and Expansion Act, enacted in 1989, authorized the Secretary of the Army, upon completion of a General Design Memorandum (GDM), to modify the CS&F project to improve water deliveries to ENP and take steps to restore ENP natural hydrologic conditions. The project modifications authorized under this Act are referred to as the Modified Water Deliveries project. The Act also provided that if the Secretary of the Army determined that the residential area within the East Everglades known as the "Eight and One-Half Square Mile Area" (8.5 SMA) or adjacent agricultural areas would be adversely impacted by the MWD, the Secretary of the Army was authorized and directed to construct a flood protection system for the presently developed land within the 8.5 SMA and the adjacent agricultural area. In accordance with the authorization, the flood protection system for the 8.5 SMA was limited to that which would be necessary to mitigate impacts that would result from the implementation of the MWD project.

The operating plan for the MWD project was to be based on the findings of the Experimental Program. When the USACE completed the GDM for the MWD project in 1992, the operational plan identified in the GDM was not considered final. The recommended plan was selected on the basis of expected environmental benefits derived from a modified water delivery schedule. The plan consisted of a Rain-Driven Water Delivery Schedule and several structural modifications to the C&SF Project designed to improve the location, timing and volume of water deliveries to ENP. The GDM called for hydrologic modeling, coordination of modeling results, and environmental evaluations to develop an acceptable water control plan. The GDM also recognized that review and adjustment of project operations would continue as experience and additional assessment of data revealed potential for improvement.

4.4 Corps of Engineers Flood Damage Reduction Policy for Civil Works Projects

The USACE is authorized by Congress to implement projects which reduce the severity and frequency of flood damage (flood damage reduction projects). As noted before, the USACE's terminology has shifted towards the use of the term "flood damage reduction" projects, as opposed to "flood protection" projects and other commonly used terms such as level of protection, to better convey the intended function of federally authorized flood projects.

The authorization by Congress for a flood damage reduction project does not constitute a legal entitlement to a certain level of flood protection or obligate the USACE to provide a certain level of protection. In general, project authorization provides for the construction and operation of project features of a specific scale (e.g.: levee – height and length; channel – width; reservoir – storage capacity). Therefore, the USACE's flood damage reduction projects are analyzed, described and authorized in terms of their expected performance, which may include reference to a level of protection which would result

from implementation of the project. Projects are designed to *reduce the frequency and severity* of damaging levels of flood inundation and are not designed to eliminate all instances of flooding. Intrinsic to the design of flood damage reduction projects is the recognition that all areas within the basin are subjected to various levels of inundation due to ground surface topography, groundwater flow characteristics and the land use patterns forecasted for the 50-year project design life.

Inherent in the authority of the USACE to implement flood damage reduction projects, is the recognition that conditions within a project area may change over time due to circumstances outside the control of the federal government. Examples of such changes include differences between what was forecasted and actual population growth and land use within a project drainage basin, which may alter the performance of a project over time. As such, authorizations for flood damage reduction projects may include responsibilities for state and local governments to provide local drainage works, flood fighting, floodplain regulations and land use planning. These responsibilities are specified in the Project Cooperation Agreement between the federal government and the local sponsor.

The USACE's regulations for the initial design of flood damage reduction projects identify key variables that must be explicitly incorporated into the risk-based analysis of flood damage reduction projects. At a minimum, the stage-damage function for economic studies, discharge associated with exceedance frequency for hydrologic studies, and conveyance roughness and cross-section geometry for hydraulic studies must be incorporated in the analysis. The analyses capture and quantify the extent of risk and uncertainty and enable quantified tradeoffs between risk and project cost. Decision making considers explicitly what is gained and what is lost. Contingencies are acknowledged and residual risk is not routinely reduced by overbuilding or by inclusions of freeboard.

4.5 Level of Protection and Project Performance

Projects are analyzed in terms of expected performance in a project design flood, not in terms of level of protection. Project performance is based upon the project's ability to remove a specific volume of water associated with the flood adopted for project design over a specified duration for the drainage area for which the project was designed. "Level of protection" is a term that can be used to describe the effectiveness of a drainage project. This commonly used term is more easily understood by the public but is less descriptive/definitive and therefore more prone to misinterpretation. For example, a 1-in-10 year level of protection is intended to provide an acceptable level of risk for a storm having an average return frequency of once in ten years. It does not guarantee that damage will not occur more than once every ten years as storm events meeting the design criteria (antecedent conditions, storm duration and volume) may occur more frequently. Specifically, this does not ensure that projects, under adverse conditions such as back-to-back storm events or extremely wet antecedent conditions, will provide that level of protection. As such, there is always an inherent risk of flood associated with any level of protection. In addition, damage can occur more frequently even without storms

exceeding the specified level of protection if the at-risk facilities (e.g. buildings) do not meet the project assumptions (e.g. house pad elevation or existence of a secondary system).

The terms "level of protection" and "project design flood" (e.g. the project design flood for the C-111 project is 40 percent of SPF) are not necessarily synonymous. Many factors may influence the calculation of the volume of water for a given frequency event. For instance, the expected rainfall for a particular frequency event may increase as a result of using a longer period of record rainfall data set. This in turn may show that the volume of water that was once expected in a 1-in-10 year event may change to be expected in association with a 1-in-8 year frequency event. Another important factor that may influence the volume of water computed for a particular frequency flood event includes any increase in runoff due to development within watershed. For example, increases in paved areas associated with urban development may increase runoff. It is for just such reasons that project performance is based upon the ability to manage the volume of flood waters computed for the project's "design flood" as opposed to an evaluation of the "level of protection" provided in a particular frequency flood event. Accordingly, land use changes such as these do not obligate the USACE to retrofit the project.

4.6 CSOP Flood Damage Reduction Evaluation

At the time of the South Dade Project 1962 authorization, the land use in the basin was reported to consist of 6300 acres urban, 39,910 acres of truck crops, 14,000 acres of sub-tropical fruit and 57,900 acres of undeveloped land (1959 Survey Review Report on South Dade County). The land use projections for 2010 were estimated to be 106,000 acres urban, 0 acres truck crops and 12,050 acres of subtropical fruit. The report further noted that since the period of most probable flood occurrences and maximum truck crop production did not coincide, the estimated reduction in damages provided by the project was based on only those truck crops actually under cultivation during the flood season, which equated to roughly 29 percent of the gross area flooded.

During the CSOP study, the flood damages for the area under the authorized 40-percent standard project flood will be evaluated for the land use conditions that exist today. Although the USACE is not liable or obligated to provide a certain level of performance due to changes in agricultural practices or land use within the C-111 basin, (See Figure 1) CSOP will strive to ensure that the project provides the expected benefits consistent with the authorizing documents submitted to the Secretary of the Army and Congress. Included in the CSOP evaluations will be assessments of the project's performance in accordance with its intended design. An additional objective for CSOP will be to explore opportunities to enhance flood damage reduction in the C-111 basin east of L-31N and C-111 canals, within the USACE's authorizations for CSOP, consistent with the restoration objectives and operational considerations. It is the intent of the CSOP study to conduct simultaneous evaluations of both flood damage reduction and ecosystem restoration in order to identify an optimal level of project performance that meets the objectives of the project as previously stated (Section 3).

The CSOP authorities do not provide for C&SF project modifications for improvements in flood damage reduction. However, it is also important to recognize that there are two other efforts, the Miami-Dade Regional Canal Study and the C-4 General Re-evaluation Report, (described below in Section 1.6) within the CSOP study area underway to address the flood damage reduction issues that are outside the C-111 and MWD projects' authorities to implement.

4.7 Other Flood Reduction Projects in Miami-Dade County

4.7.1 Miami-Dade Regional Canal Study

This study is being prepared by the USACE in response to a House Resolution dated May 23, 2001, which reads as follows:

> *"That the Secretary of the Army, is requested to review the report of the Chief of Engineers on Central and Southern Florida, published as House Document 643, Eightieth Congress, Second Session, and other pertinent reports, to determine whether modifications of the recommendations contained therein are advisable at the present time, in the interest of flood damage reduction, and other related water resource problems in the vicinity of Miami-Dade County, Florida"*

The study area consists of much of eastern Miami-Dade County, Florida. The USACE will be reevaluating the flood damage reduction features of the original C&SF report and determining solutions to current and future flooding concerns. A full array of alternative solutions will be investigated and maximization of net benefits will drive recommend plan selection. Close coordination with the Comprehensive Everglades Restoration Plan (CERP) efforts to the west will be critical.

The expedited Reconnaissance study and development of a Project Management Plan is expected to be completed in 2003 at 100% federal cost. If the Reconnaissance study determines that there is federal interest and a willing non-federal sponsor, it will then be followed by a detailed feasibility level of study.

4.7.2 The C-4 Canal Limited Re-evaluation Report (LRR)

The C-4 project was originally authorized by Congress under the Flood Control Act of 1948, with further authorization in Section 204 of the Flood Control Act of 1950. The purpose of this reevaluation is to take a re-look at the USACE's originally authorized plan, which was not constructed to the original design template.

The C-4 canal is located in Miami-Dade County, Florida. The C-4 canal extends from the levee L-30 intersect in the west, to an outlet in the Miami Canal (C-6) within the City of Miami. The C-4 study basin, which is approximately 51,680 acres located in eastern Miami-Dade County, would include the cities of Sweetwater, Belen, West Miami and portions of unincorporated Miami-Dade County.

Recent severe flooding in the vicinity of C-4 Canal has prompted the need to reevaluate the existing conditions of the C-4 canal. This reevaluation is being conducted by the USACE to investigate the effectiveness of the existing canal conveyance and to determine the economic justification of completing the originally authorized plan for the C-4 basin.

5.0 Definitions and Authorizing Documents

5.1 Definitions of Study Purpose, Authorized Project Objectives, Additional Objectives, Constraints, Assumptions, Issues, Performance Measures and Performance Indicators

The definitions of terms used in this document are**:**

1. Study purpose: means the summary statement of the authorized project purposes, based on the authorizing documents listed in Table 1 herein, for both the MWD and C-111 projects.

2. Authorized Project Objectives: means objectives that are based on the authorizing documents listed in Table 1 for both the MWD and C-111 projects. These are the objectives that CSOP is trying to achieve and that must be considered.

3. Additional Objectives: means objectives that may be considered if they appear likely to improve and not diminish authorized MWD and C-111 project objectives. Additional Objectives must be consistent with project authorizations and within USACE authority to implement.

4. Constraints: means limits imposed on the CSOP from applicable statutory and regulatory requirements.

5. Assumptions: means study parameters for the CSOP resulting from prior agency actions involving the MWD and C-111 projects and accepted by the CSOP sponsoring agencies as starting points.

6. Issues: means concerns that are identified by the participants in the CSOP EIS process as appropriate for consideration and that are not classified as Project Authorized Objectives, Additional Objectives, or Constraints.

7. Performance Measures: mean qualitative or quantitative indicators that have a specific target or range indicating how well, or poorly, an alternative meets an Authorized Project Objective, Additional Objective, Constraint or Issue.

8. Performance Indicators: mean qualitative or quantitative indicators without a specific target or range, but with an established benchmark, (e.g. higher is better,

a certain range is preferred), indicating how well, or poorly, an alternative meets an Authorized Project Objective, Additional Objective, Constraint or Issue.

5.2 Authorizing Documents

The purposes of the MWD project and the C-111 project are derived from the authorizing documents listed in Table 1:

Table 1

1. Everglades National Park Protection and Expansion Act of 1989. ("**Everglades 1989 Act**")
2. USACE, Modified Water Deliveries to Everglades National Park, General Design Memorandum and Environmental Impact Statement, June 1992. ("**USACE 1992 MWD GDM**")
3. USACE, Final Integrated General Reevaluation Report and Environmental Impact Statement, Canal 111 (C-111), May 1994. ("**USACE 1994 C-111 GRR**")
4. December 2000 Final Environmental Impact Statement and Record of Decision on the 8.5 Square Mile Area Project. ("**2000 8.5 SMA FEIS**")
5. 2001 GRR and Draft Supplemental Environmental Impact Statement on the Tamiami Trail Project. ("**2001 TTP DSEIS**")
6. USACE, Final Integrated General Reevaluation Report Supplement and Environmental Assessment, Canal 111 (C-111), January 2002. ("**USACE 2002 C-111 GRRS**")
7. July 2002, 8.5 Square Mile Area General Reevaluation Report and Supplemental Environmental Statement **("July 2002 8.5 SMA GRR/SEIS")**

Other relevant, background documents helpful in understanding the purposes of the MWD project and the C-111 project are listed in Table 2:

Table 2

1. January 2000 Value Engineering Report for Conveyance and Seepage Control. ("**2000 VER**")
2. 1999 Biological Opinion for the Modified Water Deliveries to Everglades National Park project, Experimental Water Deliveries Program, and the C-111 Project. ("**1999 Biological Opinion**")
3. 2002 Final Amended Biological Opinion for the USACE's Interim Operating Plan (IOP) for Protection of the Cape Sable Seaside Sparrow. ("**2002 Biological Opinion**")